5.6

7)

$\frac{x}{e} = \frac{6}{10} = \frac{c}{b} = \frac{a}{y}$

$\frac{d}{e} = \frac{8}{10} = \frac{x}{b} = \frac{f}{y}$

$\boxed{\frac{x}{d} = \frac{6}{8} = \frac{c}{x} = \frac{a}{f}}$

$\boxed{y = 10 - c - d}$

$\frac{6}{10} = \frac{a}{y}$ so

$6y = 10a$

$3y = 5a$

$\frac{8}{10} = \frac{f}{y}$ so $8y = 10f$

$4y = 5f$

$y = 10 - c - d$

$y = 10 - \frac{6x}{8} - \frac{8x}{6}$

$y = 10 - \frac{3}{4}x - \frac{4}{3}x$

$y = 10 - \frac{9x}{12} - \frac{16}{12}x$

$y = 10 - \frac{25}{12}x$

$\text{Area} = xy$

$= x\left(10 - \frac{25}{12}x\right)$

$= 10x - \frac{25}{12}x^2$

A'

5.6

7)

$\frac{x}{e} = \frac{6}{10} = \frac{c}{6-a} = \frac{a}{y}$

$\frac{10-c-y}{e} = \frac{8}{10} = \frac{x}{6-a} = \frac{8-e}{y}$

$\frac{x}{10-c-y} = \frac{6}{8} = \frac{c}{x} = \frac{a}{8-e}$

$\frac{6}{10} = \frac{a}{y}$ so

$6y = 10a$

$3y = 5a$

$\frac{8}{10} = \frac{f}{y}$ so $8y = 10f$

$4y = 5f$

$4y = 5(8-e)$

$4y = 40 - 5e$

$y = 10 - \frac{5}{4}e$

$\frac{x}{e} = \frac{a}{y}$ so $xy = ae$

= Area

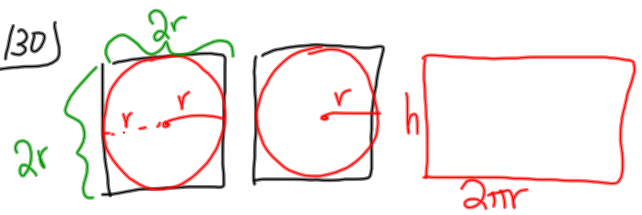
Area = xy =

$\frac{x}{6-a} = \frac{8-e}{y}$

so $xy = (8-e)(6-a)$

$= 48 - 6e - 8a + ae$

5.6/30



we know $V^* = \pi r^2 h$ $\quad$ * constant

$\boxed{\text{minimize material used}}$

$M = 2\pi r h + 2(2r)^2 = 2\pi r h + 4r^2$

but $h = \dfrac{V}{\pi r^2}$ always true

so

$M = 2\pi r\left(\dfrac{V}{\pi r^2}\right) + 4r^2 = \dfrac{2V}{r} + 4r^2$

$(r^{-1})' = -1(r)^{-2}$

$M' = \dfrac{-2V}{r^2} + 8r = 0$ $\quad$ Osprey

$-2V + 8r^3 = 0$ so $8r^3 = 2V$

$r^3 = \dfrac{V}{4}$

$\boxed{r = \left(\dfrac{V}{4}\right)^{1/3}}$ → makes M minimum

so $\dfrac{r}{h} = \dfrac{\left(\dfrac{V^{1/3}}{4^{1/3}}\right)}{\dfrac{V}{\pi r^2}} = \dfrac{V^{1/3}}{4^{1/3}} \cdot \dfrac{\pi r^2}{V}$

$= \dfrac{V^{\frac{1}{3}}}{4^{\frac{1}{3}}} \cdot \dfrac{\pi}{V} \cdot \dfrac{V^{2/3}}{4^{2/3}} = \dfrac{\pi}{4}$

Optimization

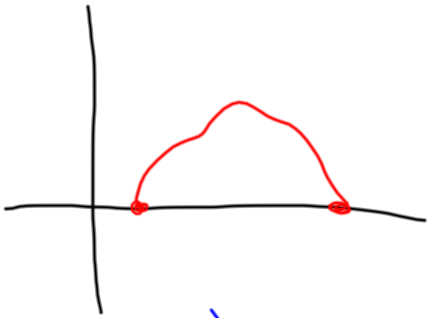
→ Picture [[helps "find" the equation]]
("see")

→ Goal 1:
- equation that is always true.
- 1 independent variable

→ Goal 2: find end points and CRITICAL NUMBERS
- take first derivative
  - $f' = 0$
  - f' undefined

→ Conclusion

Typical equation/function



Extreme Value Theorem (EVT)

If a function $f(x)$ is continuous on a CLOSED INTERVAL

Then $f(x)$ has an absolute maximum value and an absolute minimum value on that interval.

Consider $y = x$ on the interval $(0, 1)$.

Does it have ~~or~~ a maximum?

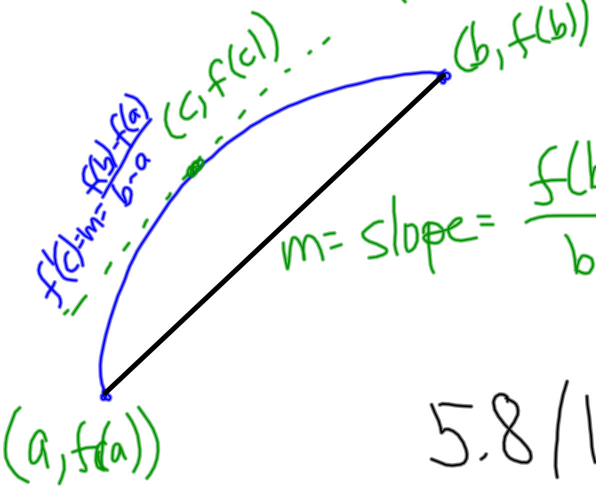
Nov 30-7:32 AM

Mean Value Theorem (MVT)

If a function is continuous on a CLOSED INTERVAL $[a,b]$
AND also differentiable on the OPEN interval (a,b)

Then there is a point ($x=c$ in (a,b))
where $f'(c) = \dfrac{f(b)-f(a)}{b-a} = m =$ slope

MVT, the picture



$$m = \text{slope} = \frac{f(b)-f(a)}{b-a}$$

5.8/1-16